Reconstruction of shoreline orientation and progradation rates in the high-energy mesotidal Central Coast of Portugal

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Understanding the shoreline history of the sandy beaches is essential to assess its vulnerability to erosion. For that, we propose a methodological framework for the reconstruction of shoreline configuration over time and present the preliminary results from its application to the high-energy mesotidal Central Coast of Portugal. The study area is located south of the Aveiro Estuary, a barrier-lagoon system permanently connected with the open ocean through an artificially stabilized inlet. The growth of the barrier island reached the study area in the 18th century. However, it remains unclear how the coast evolved to the south of the estuary, and which was its relation with the infilling and enclosing of the updrift estuary. Here, we attempt to reconstruct the history of a prograding shoreline using the record of beach clinoforms and erosional scarps reaching the base of the dune.

Shoreline reconstruction over time is being carried out combining geophysical, sedimentological and dating techniques. As a first approximation, geophysical surveys using a Ground Penetrating Radar (GPR) were carried out alongshore and acrosshore in order to identify the recorded sedimentary facies and the associated depositional environments. Sediment cores were collected along the GPR lines to groundtruth the geophysical information and to sedimentologically characterize the identified depositional environments.

Preliminary results report the presence of a roughly 11m high and 180 m width foredune, which extends along the 28 km of analyzed shoreline. A topographically low lying plain separates the foredune from a transgressive dune field characterized by the presence of parabolic and transverse dunes which extend 10 km inland. Geophysical and sedimentary results documented: (i) the seaward progradation of beach deposits cored on (ii) inherited topographies located below the water table and interpreted as ancient dunes deposited when the sea level was lower and seaward from today, (iii) thin layers of modern dunes cover the prograding beach deposits within the low plain where they seem to have been blown by the wind feeding the already existent transgressive dunes. A detailed analysis of the beach clinoforms together with the frequency and shape of the erosional scarps, and the morphology of the beach-dune transition permitted the assumption of variable alongshore progradation rates in relation to the orientation of the former shoreline as obtained from the radargrams. These assumptions need future confirmation including the date of different layers to calculate the actual progradation rates. This work demonstrates that reconstructing the complex history and configuration of a shoreline can be accomplished through the analysis of subsurface images provided by GPR in combination with sediment cores.

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